We claim:

1. A process for the continuous heterogeneously catalyzed partial dehydrogenation of at least one hydrocarbon to be dehydrogenated in the gas phase, in which

- a reaction gas comprising at least one hydrocarbon to be dehydrogenated is fed continuously to a reaction zone,
- the reaction gas in the reaction zone is conveyed over at least one fixed catalyst bed over which molecular hydrogen and at least one dehydrogenated hydrocarbon are formed by catalytic (partial) dehydrogenation,
- at least one gas comprising molecular oxygen is added to the reaction gas before and/or after entry into the reaction zone,
- the molecular oxygen in the reaction zone oxidizes part of the molecular hydrogen present in the reaction gas to water vapor, and
- a product gas comprising molecular hydrogen, water vapor, the dehydrogenated hydrocarbon or hydrocarbons and the hydrocarbon or hydrocarbons to be dehydrogenated is taken from the reaction zone,

wherein the product gas taken from the reaction zone is divided into two substreams of identical composition and one of the two substreams is recirculated as circulated gas to the reaction zone.

2. A process as claimed in claim 1, wherein the fixed catalyst bed or beds is made up of dehydrogenation catalysts comprising from 10 to 99.9% by weight of zirconium dioxide, from 0 to 60% by weight of aluminum oxide, silicon dioxide and/or titanium dioxide and from 0.1 to 10% by weight of at least one element of main group I or II, an element of transition group III, an element of transition group VIII of the Periodic Table of the Elements, lanthanum and/or tin, with the proviso that the percentages by weight add up to 100% by weight.

3. A process as claimed in claim 1 or 2, wherein the fixed catalyst bed comprises catalyst extrudates and/or catalyst rings.

4. A process as claimed in any of claims 1 to 3, wherein the hydrocarbon to be dehydrogenated is propane and/or butane.

5. A process as claimed in any of claims 1 to 4, wherein at least one gas comprising molecular oxygen is added to the reaction gas exclusively before it enters the reaction zone.

6. A process as claimed in any of claims 1 to 5, wherein air is added as at least one gas comprising molecular oxygen.

7. A process as claimed in any of claims 1 to 6, wherein apart from the circulating gas no further gas comprising molecular hydrogen is introduced into the reaction zone.

8. A process as claimed in any of claims 1 to 7, wherein the reaction gas fed to the reaction zone contains water vapor.

9. A process as claimed in any of claims 1 to 8, wherein the substream of the product gas taken from the reaction zone which is recirculated as circulating gas to the reaction zone amounts to from 20 to 80% of the product gas taken off.

10. A process as claimed in any of claims 1 to 9, wherein the substream of the product gas which is not recirculated as circulating gas to the reaction zone is, if appropriate after part of the components present therein other than the dehydrogenated hydrocarbon or hydrocarbons have been separated off, used for the partial oxidation and/or amoxidation of the dehydrogenated hydrocarbon.

11. A process as claimed in any of claims 1 to 10, wherein the reaction gas further comprises an added second circulating gas which comprises the hydrocarbon or hydrocarbons to be dehydrogenated and comes from a partial oxidation and/or amoxidation of the dehydrogenated hydrocarbon.

12. A process as claimed in any of claims 1 to 11, wherein the second circulating gas which comes from the partial oxidation and/or amoxidation of the dehydrogenated hydrocarbon and is recirculated to the reaction zone is the only gas comprising molecular oxygen which is added to the reaction zone.

13. A process as claimed in any of claims 1 to 12 carried out in a jet pump circulation reactor.

14. A reactor comprising at least one catalyst bed which is suitable for the catalytic dehydrogenation of hydrocarbons to be dehydrogenated and at least one jet pump.